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**Région des Maritimes**

**Proceedings of a Maritimes Science  
Advisory Process to Assess the Arctic  
Surfclam (*Mactromeris polynyma*)  
Stock on Grand Bank**

**September 7-8, 2010**

**Ross Claytor  
Meeting Chair**

**Compte rendu de la réunion tenue  
dans le cadre du Processus  
consultatif scientifique de la Région  
des Maritimes pour évaluer le stock de  
mactre de Stimpson (*Mactromeris  
polynyma*) du Grand Banc**

**Les 7 et 8 septembre 2010**

**Ross Claytor  
Présidente de la réunion**

Bedford Institute of Oceanography  
1 Challenger Drive, P.O. Box 1006  
Dartmouth, Nova Scotia  
B2Y 4A2

**July 2011**

**Juillet 2011**

## **Foreword**

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

## **Avant-propos**

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenues dans le présent rapport puissent être inexactes ou propres à induire en erreur, elles sont quand même reproduites aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considérée en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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### SUMMARY

A Maritimes Region Science Advisory Process to assess arctic surfclam was held on September 7-8, 2010, at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Participants included DFO Science and Resource Management, provincial fisheries management, as well as Industry representatives. The results of this meeting will be used to support management decisions related to the fishery in 2011.

### SOMMAIRE

Une réunion s'est tenue dans le cadre du Processus consultatif scientifique de la Région des Maritimes les 7 et 8 septembre 2010, à l'Institut océanographique de Bedford, à Dartmouth en Nouvelle-Écosse. Elle avait pour but d'évaluer le stock de mactre de Stimpson. Y participaient des représentants des Sciences et de la Gestion des ressources du MPO, des services provinciaux de gestion des pêches et de l'industrie. Les résultats de cette réunion serviront à appuyer les décisions de gestion concernant la pêche de 2011.





## INTRODUCTION

The Chair of the meeting, R. Claytor, welcomed participants (Appendix 1) and thanked them for coming to this DFO Science Advisory Process to assess arctic surfclam and the surfclam fishery on Grand Bank, which was held 7-8 September, 2010.

The Chair noted that this was a science peer-review and advisory meeting, which meant that the primary goals of the meeting were to review the information presented by the surfclam assessment team (i.e., to ensure that it was accurate and complete) and then to review the science advice to Fisheries and Aquaculture Management (FAM) based on this information. The objective of the meeting was reviewed:

- Applying the assessment framework for offshore clams, identify a range of fishing mortality and TAC options for the harvesting strategy in relation to  $F_{current}$  and  $F_{MSY}$  for Arctic surfclams on the Grand Bank.

The chair advised participants that discussions during the meeting would focus on the science, survey results and habitat effects. The chair also noted that no  $F$  target had been proposed for this assessment. Rather discussions and advice provided during the assessment would be used by FAM to determine a harvesting strategy

To assist in this review, S. Smith (Population Ecology Division) had offered to act as an impartial reviewer. In addition, the Chair encouraged other participants to provide a critical review of the information presented based on their knowledge and expertise about surfclam and the clam fishery.

To guide discussions, a working paper had been prepared, which would be produced as a research document upon acceptance. A Science Advisory Report (SAR) would also be produced as a result of this meeting. This Proceedings report is the record of the discussion of the meeting.

Participants noted that since the working paper was not distributed for review prior to the meeting, it was difficult to come to the meeting fully prepared. Future efforts should be made to ensure appropriate documents are made available to participants in an appropriate time frame.

The Agenda (Appendix 2) was reviewed, and no further additions or corrections were made.

## ASSESSMENT

**Working Paper:** Roddick, D., J. Brading, L. Carrigan, T. Davingnon-Burton, S. Graham, and C. McEwen. 2010. Assessment of the Arctic Surfclam (*Macromeris polynyma*) Stock on Grand Bank. CSA Working Paper 2010/013.

**Presenter:** D. Roddick

**Rapporteurs:** L. Bennett and T. McIntyre

### *Presentation Highlights*

Following the development of a fishery for Arctic surfclam on Banquereau, a fishery was established on Grand Bank in 1989. The TAC on Grand Bank was set at 20,000 t in 1989 and

has been rolled over at the same level to the present. This is the first assessment of Arctic surfclam on Grand Bank.

### Survey Design

A survey of the Grand Bank Arctic surfclam occurred in 2006, 2008 and 2009 with different areas of the bank surveyed each year. A total of 772 stations were sampled throughout the survey. Several complications associated with the survey were noted and included changing vessels after the 2006 portion of the survey, differences in the types of dredges used during each portion of the survey and changes in the methods used to land the dredges.

In 2006 the dredge was a chain bag and codend which was set and landed from the side of the vessel. In 2008, a new dredge was constructed based on the 2006 design, and was set and landed from the stern of the new survey vessel. Due to problems landing over the stern and safety concerns, a ramp and runner system was installed on the stern of the vessel for 2009. The dredge was also changed from a chain bag and codend to a full cage. The latter design retained smaller sizes than the chain bag or commercial dredges.

From each tow, a sample of the catch up to a 5 bushel sample was processed to estimate catch composition of all species present. Then up to an additional 20 bushel sample was processed to estimate the catch composition of major bivalve species. The catch of major bivalves was thus based on a 25 bushel sample, and other catch components on a 5 bushel sample.

### Comments

There were no comments or questions concerning this section

### Dredge Efficiency

A dredge efficiency study was completed in 2009. Three tows were completed to estimate the overall density within the area. An additional 15 overlapping tows were completed and Rago's patch model used to estimate dredge efficiency.

It was noted that the results indicate an issue with the dredge efficiency study. Results of the model indicate a negative slope: the model is predicting a greater decline with subsequent tows than is observed, thus underestimating dredge efficiency. This was true even for runs where the estimated efficiency was 1. This indicates that the model was not working for this data set. For the present analysis the efficiency was assumed to be 1. This is a conservative approach, but means that the biomass is underestimated by an unknown amount.

### Comments

While estimating the initial density of the depletion study the results of tows two and three indicate a non-uniform density. It was noted that removing tows two and three from the analysis did not significantly change the results and would therefore be removed.

### Dredge Selectivity

Dredge selectivity experiments were conducted in 2009. The dredge was fitted with a loose mesh cover which collected catch escaping through the dredge. Three tows were completed in 2009 with the data corrected to the 2006 and 2008 survey results.

### Comments

The reviewer indicated that data from the selectivity study should be used to estimate the length frequencies of each such survey so that a population estimate could have been obtained for each year rather than correcting the 2009 data to each additional survey. It was suggested that this method does not provide a good estimate of smaller sized clams as seen in the selectivity results. Using the selectivity results of each year directly would allow for the inclusion of smaller sizes which would result in a higher biomass estimate. This would not affect the estimate of fishable biomass. A participant concurred with the reviewer indicating that the overall population estimate for an area should be completed within each year rather than correcting for gear between years to generate a population estimate. Likewise the gear selects for larger sizes and a large part of the analysis is based on a clam size that is poorly selected by the gear. Roddick replied that by correcting the 2009 data however, only one data set was adjusted, and adjusting the 2006 and 2008 surveys would mean bumping up numbers from sizes with very low selectivity, adding to the uncertainty in the estimates. Likewise the data was corrected closer to the commercial selectivity pattern.

### Recommendations

Selectivity tows over a dedicated period of time should be added to future surveys. Although this would take up some time, it may be helpful to sacrifice survey tows covering an area for tows on efficiency and selectivity.

### Ageing

A random sub-sample was processed for ageing. The age frequency distributions indicate fluctuations in recruitment through time.

All agers went through training and were periodically tested. A coefficient of variance (CV) of 5 or less had to be achieved by each ager before they could routinely age samples. A CV of 2.2% was achieved by the agers.

### Comments

There were no questions or comments concerning the methods used to age the clams.

### Mortality

Since there has been a commercial fishery, it was assumed that the natural mortality of clams was equal to the total mortality minus the fishing mortality. The four methods to estimate mortality: (1) Amerstunge and Rowell, (2) Dawafon and Hall, (3) Chapman and Robson, Ricker (catch curve method) and (4) Chapman Robson (C-R) estimate were discussed. In an effort to avoid errors by trying to convert data to a common year, mortality estimates were completed for each year of the survey.

### Comments

There was a discussion regarding the size and age of the clams used for the estimates. The methods used require that only agesizes fully selected by the gear be used for the analysis. Based on the selectivity curve, a minimum age cut off of 30 years for the 2006 and 2008 survey and 25 years for 2009 survey was used.

It was clarified that the mean length of the fishable population rather than the population were used in the mortality calculations.

#### *Recommendations*

It was recommended that a comparison of selectivity at age be incorporated into the analysis. This could help determine if the differences in mortality are a result of spatial or temporal differences. The use of selectivity could also help to build up lower ages into the estimate. It was noted however, that including selectivity would introduce a lot of variability into the estimate since the selectivity is so low that a good estimate of lower ages could not be provided.

The four methods used to estimate mortality provided estimates ranging from 0.06 to 0.100. It was recommended that the current mortality estimate of 0.08 continued to be used.

#### **Recruitment**

For each survey, recruitment estimates were calculated for clams aged 25 years. The pattern varied between surveys indicating either a problem due to the number of clams aged or that there are differences in recruitment patterns in different areas of the bank.

It was noted that with the numbers of aged clams and the large range of ages present, it is a small sample to use to convert sizes to ages and then estimate recruitment. Although it is our best estimate of recruitment, the data is being pushed farther than usual to get an estimate of recruitment.

#### *Comments*

There was a discussion on the life history of the surfclam. The surfclam settles on a sandy bottom and immediately require an adult environment. The size and age at 50% maturity were 39.9 mm and 5.3 years, respectively while the size and age at 50% selectivity is 87.4 mm and 22.9 years, respectively. As clams have over 17 years of spawning before they enter the fishery and are larger than the size of maximum biomass per recruit, recruitment and growth overfishing are unlikely to occur. It was noted that the size and age of maturity of clams on Grand Bank are smaller and younger than that of the Banquereau population, which were 47.2 mm and 6.7 years, respectively.

Areas with a large clam population do not appear to have high recruitment.

It was noted that recruitment estimates are dependant on the size of the clam selected into the fishery. As a result of insufficient information, any changes in recruitment as a function of density cannot be examined.

It was also noted that a lot of information regarding recruitment dynamics remain unknown. It was suggested that an investment in the understanding of recruitment dynamics and the creation of robust management plans to ensure the fishery is sustainable is necessary.

#### **Biomass Estimates**

Results of the 2009 survey were corrected to 2006 and 2008 selectivity. Since the size was close to commercial selectivity, an estimate of fishable biomass and not the whole population was calculated. There is no minimum size limit in the fishery, rather all sizes are kept.

The ACON package assumes an exponential decay for the inverse distance spatial correlation.

#### *Comments*

A participant inquired whether kriging had been examined and if there was any anisotropy in the data. Roddick indicated that kriging indicated a 2 kilometer range. Likewise a directional effect on the relationship (anisotropy) was provided in kilometer range with catches more similar in the north-south direction as opposed to the east-west direction.

Questions were asked about the selection of the survey area and the number of tows within an area. The response was that the survey area was determined in 2006 largely from industry input and with the use of some data from the 1996-97 surveys. It was noted that within high density areas there appears to be fewer tows. It was clarified however, that the locations of the tows were random and not stratified.

In response to questions concerning how biomass estimates were calculated it was clarified that the overall biomass estimate uses the mean of all tows. A participant indicated that the biomass is underestimated due to uncertainties with high density areas not as well defined as low density areas. When completing biomass estimates, the assumption is made that when there are no clams in an area it is for the same reasons (e.g. area is too rocky, clams are being out competed by other bivalves). It was suggested that estimates should not be extended into some areas.

It was reported that within the southern area, industry had tried some exploratory fishing and was unable to find concentrations of clams as indicated by the survey results.

A participant inquired whether there was enough habitat information to estimate clam habitat in areas where no tows were completed. Roddick indicated that SeaScan exists for all areas that had stations whether or not they were towed. It was further indicated that the overall distribution was well described but detail will vary depending on the sampling intensity and that the coverage of bottom habitat is not good enough to derive specific habitat maps.

As the spatial pattern of clams could provide information concerning their habitat requirements it was suggested that examining how the spatial pattern represents the population should be further investigated.

#### **Growth**

##### *Comments*

It was noted that the fishable length frequency should be compared to the population length frequency.

A participant asked whether the spatial growth curve was fitted to the different regions of the bank and whether a growth curve was completed for each survey. Roddick indicated that the spatial growth curve was not fitted to different areas of the bank but expected to see a lot of spatial variation due to the size of the bank. Growth curves were not completed for each survey however, it would not be difficult to complete.

A participant noted that if there is spatial variability, given the location of tows and not fitting the growth curves, data may be over-estimated as each data point is treated as independent.



Rather, each tow should be considered a data point as opposed to each individual point within a tow.

#### *Recommendations*

Growth curve should include spatial differences to provide a better overall curve.

#### **By-Catch**

By-catch was estimated for the whole survey and separately for tows having a catch greater than 100 g/m<sup>2</sup>. It was also compared to data collected from sampling programs aboard the commercial vessels.

#### *Comments*

It was noted that although the methods used by the observers of the International Observers Program (IOP) are not reported, it was thought that the composition was estimated visually as the list of species identified by the IOP are much shorter than those from the survey and are dominated by larger, easily identifiable species.

There was a discussion concerning the differences between the IOP and survey results. It was also noted that the percentage of Arctic surfclam reported by the IOP is higher than that reported in the survey. Several proposed explanations for the difference include the fishery concentrating on higher abundance areas, a bias in visual estimates, and commercial dredges retaining less by-catch than survey dredges.

It was noted that with the exception of other bivalve species, the amount of by-catch was low. Unidentified skate species were noted in the IOP list and 2006 survey data outside of the high biomass areas. Winter skate on Georges Bank and Western Scotian Shelf are listed as special concern by COSEWIC while winter skate on the Eastern Scotian Shelf and the Southern Gulf are listed as threatened and endangered, respectively. Currently, Grand Bank thorny and winter skate are not listed by COSEWIC and thus are not an issue for the surfclam fishery. If these species are listed in the future, skate by-catch may become a concern.

It was noted that clarification concerning Table 4 is required. The table should include a caption explaining why the weight of three species within the table is listed as zero.

#### **Biomass Distribution**

##### *Comments*

Despite being 4.8 times as large, the biomass estimate for Grand Bank is 78% of the estimate for Banquereau. It was noted by industry participants that given their experiences with catch rates on the two banks this estimate appears to be high.

Concern was expressed that by estimating biomass in areas where no catches have been recorded the distribution of the species maybe over-represented.

It was noted that within the middle of the survey area there are areas with zero biomass next to areas that have a medium density of clams. Having tows with zero biomass isn't predictive of fishing success due to the patchiness of habitat type.

Data is available that shows clams on Grand Bank are smaller at age in comparison to Banquereau. It was also indicated that catch rates are also lower on Grand Bank.

It was questioned why area 2 was not surveyed. It was clarified that since no clams were reported in the southern portion of Area 2 when it was sampled in 1996, it was excluded from future sampling. The northern portion of Area 2 was not excluded as clams were found in areas immediately adjacent to it.

### **Ecosystem and Habitat**

The results of a ten year dredge impact study examining the impacts of clam fishing on the habitat and benthic community of Banquereau were discussed. To date visual methods do not detect dredge tracks after one year, however, sidescan sonar was able to detect tracks ten years after dredging. It was noted there was little recruitment of large bivalve species to the study site over the ten years following dredging. A separate study also indicates that track persistence may be influenced by water depth, and the study site is deeper than where the fishery currently takes place.

The impact of the fishery was discussed. It was noted that as the fishery concentrates on high density areas, there is a relatively small footprint in comparison to other fisheries. As the fishing area increases as lower density areas are targeted, however, so does the footprint of the fishery.

It was noted the grey scale used to indicate area swept in Figure 3 made it difficult to read and should therefore be changed.

## **CONCLUSIONS**

The current biomass estimate for Grand Bank surfclams is 1.14 million tonnes.

The size at 50% selectivity is larger than the size at maturity and the size at maximum cohort biomass. Recruitment and growth overfishing are not a concern with present gear.

In comparison to Banquereau, clams on Grand Bank are smaller at age thus supporting the conclusion of lower growth rates on Grand Bank.

The estimated mortality rate of 0.08 is appropriate.

The estimated Maximum Constant Yield (MCY), which is based on total fishable biomass, is 30,114 tonnes while the current Total Allowable Catch (TAC) is 20,000 tonnes.

No conclusions were made regarding what level of fishing mortality might be sustainability for this species on Grand Bank. A large portion of the population is distributed over a large area with low density. Due to the patchiness of clam habitat, an effective F on high density areas would be higher than an F target averaged over the whole area. It was recommended that selection of an F target for Grand Bank consider a range of factors, including the different growth and maturity rates for Grand in comparison to Banquereau, the patchiness and variable density of clam beds, impact of densities on an effective F and CPUE, benthic impact and bycatch issues.

### **ACKNOWLEDGMENTS**

The clam assessment team was thanked for their hard work, the reviewer for his helpful comments and suggestions and the rest of the participants for participating in the meeting.



## APPENDIX 1. List of Participants.

**Maritimes Science Advisory Process on  
Assessment of Arctic Surfclam on the Grand Bank**

Needler Boardroom  
7-8 September 2010

**ATTENDEES**

<b>Participant</b>	<b>Affiliation</b>
Bennett, Lottie	DFO Maritimes / CSA
Boyd, Catherine	Clearwater Seafoods
Brading, Josh	OHSR / DFO Maritimes
Claytor, Ross	DFO Maritimes / PED
d'Eon, Sylvain	D'Eon Fisheries Ltd.
Graham, Sara	PED / DFO Maritimes
Greening, Linde	NS Fisheries and Aquaculture
Kennedy, Jim	Louisbourg Seafoods (crab) / Northsyde Processing (shrimp)
LeBlanc, Jules	Ocean Pride Fisheries Ltd.
Leslie, Stefan	DFO Maritimes / FAM
MacInnis, Sidney	DFO Ottawa / FAM
McIntyre, Tara	DFO Maritimes / CSA
Mosher, Jim	Clearwater Seafoods
Mugridge, Adam	Louisbourg Seafoods Ltd.
Penney, Christine	Clearwater Seafoods
Peters, Gerard	DFO Maritimes / P&E
Pittman, Mike	Clearwater Deep Sea Trawlers
Roddick, Dale	DFO Maritimes / PED
Rumbolt, Annette	DFO Newfoundland / FAM
Samson, Edgar	Premium Seafoods Ltd.
Samson, Réal	Premium Seafoods Ltd.
Sarty, Matt	Clearwater Seafoods
Sciocchetti, Robert	D'Eon Fisheries Ltd
Smith, Stephen	DFO Maritimes / PED
Sullivan, Blaine	Ocean Choice
van Helvoort, Gus	DFO Maritimes / RDG's Office

**APPENDIX 2. Terms of Reference.****Maritimes Science Advisory Process on  
Assessment of Arctic Surfclam on the Grand Bank**

Date: 7-8 September 2010

Chair: Ross Claytor

George Needler II Boardroom  
Bedford Institute of Oceanography  
1 Challenger Drive  
Dartmouth, Nova Scotia

**TERMS OF REFERENCE****Context**

There has been a quota regulated fishery for Arctic surf clam on the Grand Bank since 1989, although there has not been an assessment framework developed specifically for this area and advice has been provided by DFO Science to Fisheries and Aquaculture Management on an as-needed basis. The Total Allowable Catch (TAC) for the Grand Bank has remained unchanged since 2000 at 20,000 mt.

A review of the assessment framework for other offshore banks (Banquereau and Sable banks) was undertaken during 17–18 January and 4–5 April 2007. The current assessment will apply the results of this review in support of management during the current assessment period. Advice provided during this assessment will be used to determine a harvesting strategy within the context of an Integrated Fisheries Management Plan.

**Objectives**

- Applying the assessment framework for offshore clams, identify a range of fishing mortality and TAC options for the harvesting strategy in relation to  $F_{\text{current}}$  and  $F_{\text{MCY}}$  for Arctic surf clams on the Grand Bank.

**Expected Publications**

CSAS Science Advisory Report  
CSAS Research Document  
CSAS Proceedings

**Participants**

Scientific experts from within DFO  
Industry knowledgeable in clam fisheries  
Fisheries managers

**APPENDIX 3. Agenda.**

**Maritimes Science Advisory Process on  
Assessment of Arctic Surf Clam on the Grand Bank**

7-8 September 2010

Chair: Ross Claytor

George Needler II Boardroom  
Bedford Institute of Oceanography  
1 Challenger Drive  
Dartmouth, Nova Scotia

**DRAFT AGENDA**

**7 September 2010 – Tuesday**

09:00 – 09:15	Welcome and Introduction (Chair)
09:15 – 12:00	Presentation of Assessment Working Paper
12:00–13:00	Lunch
13:00–17:00	Discussion
17:00	Adjournment

**8 September 2010 – Wednesday**

09:00 – 09:15	Review of Previous Day (Chair)
09:15 –12:00	Review of Science Advisory Report
12:00–13:00	Lunch
13:00 – end	As required

